Factors conditioning the formation of European regional convergence clubs

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Abstract

Recent findings indicate the existence of European regional convergence clubs. We examine factors conditioning the distribution of European regional GDPpc by estimating conditioned stochastic kernels, arguably the optimum method for whole distribution or partial conditionings. We also compute conditioned Markov chains for the conditioning factors detected and their sensitivity to changes in probability. Our results show that a country's fiscal policies remain the key factor in escaping from backward clubs, together with the integration of women into the labour market, reducing educational polarization and increasing the number of patents. However, the most backward regions remain trapped within their respective club.

JEL codes: O11, R11

FACTORS CONDITIONING THE FORMATION OF EUROPEAN REGIONAL CONVERGENCE CLUBS

1. INTRODUCTION

The literature on economic growth identifies the existence of groups of economies, or convergence clubs, that present homogeneous patterns and which converge towards a common steady state. Similarly, it identifies a tendency for such clubs to form around a few poles of attraction. Galor (1996) provides a useful summary of the main implications of various theoretical models, stressing the economic variables that condition the emergence of convergence clubs.

Theoretical approaches adopt either a neoclassical or an endogenous theoretical framework. Within the neoclassical framework, if heterogeneity is permitted across individuals, the dynamics of the Solow growth model can be characterised by multiple steady-state equilibriums. Most neoclassical studies assume that differences in steady state are conditioned by levels of capital, supposing that regions with the same level of capital tend towards the same steady state. Yet, some economies show a persistent deterioration that leads them towards an extreme situation, what Nelson (1956) termed a poverty trap in his pioneering study that considered two steady states in a neoclassic model. However, this is only the case when the saving rate is a growing function of the capital-labour ratio; at lower values of this ratio it will be positive. Working within the endogenous growth framework, Azariadis (1996) specifies seven possible situations that might lead to the formation of a growth trap. In this sense, externalities might explain the presence of spatial clusters of regions that share low or high levels of development, a situation that might lead to a poverty trap because of the regions' geographical location (Jalan and Ravallion, 1997).

However, this is not the case of the European regions, where development is at a much higher level than that which typically characterises a poverty trap. Although, we believe that the possibility should be considered that poorer European regional economies might be trapped within a backward convergence club. Our concern here is that economies at a lower level of development find themselves trapped in a club with no way out. Durlauf (1994) points out that when richer economies achieve a desired degree of stratification, then, a link between cross-section and intertemporal inequality is formed. In this sense, we need to consider a wide-ranging classification of all the reasons that might lead economies to a lower level of development. Factor typology has been presented by the convergence literature as a way of explaining the way in which convergence clubs are constituted. These factors, we believe, could be grouped into a four-level typology.

The first reason to take into consideration is that a lower endowment of human capital will promote lower levels of economic activity. In this sense, Azariadis and Drazen (1990) describe such a scenario arising from the existence of threshold effects related to the non-convexity of aggregated production function. Thus, externalities in the technology of human capital accumulation will bring about bifurcations that yield quite different development paths from minor differences in initial conditions. Thus, a relationship can be established between initial conditions and the steady-state performance of aggregated output. Bénabou (1994) states that stratification traps backward economies with lower human capital endowment, while those with a richer endowment continue to grow. In addition, the accumulation of human capital requires certain financing conditions (Barham et al., 1995 and Berthelemy and Varoudakis, 1996). Cohen (1996) claims that education in poorer economies has not been able to reduce initial knowledge gaps. The second reason considers lower levels of saving rates and demographic factors. Linking the first reason described above with this second factor, de la Croix (1996) indicates that the lack of financing for the education of future generations and/or the presence of low saving rates increase consumption (what Azariadis terms the "impatience trap") leading the economy into a poverty trap. The situation worsens when these conditions are perpetuated. The third factor that might generate lower development levels is R&D endowment and monopolies in technology (Erickson, 1994). Although null growth in the capital factor has not occurred in European regions, there are economies with very low growth. Low levels of elasticity usually accompany such a situation. Additionally, the characteristics that condition the market, including size (Rodríguez-Pose, 1999 - note that the size and the age of a company also affect R&D profits), structure (Baland and Francois, 1996 - self-reinforcing effects between technological change and market structure) and technological change (Galor and Ryder, 1989 and Murphy, Shleifer and Vishny, 1989), are necessary to promote growth. Nevertheless, the absence of adequate social conditions can lead to a loss of ground in the race to introduce technological improvements. Finally, the fourth reason considers that the differentiation in the parameters of production function can account for lower levels of development. In this sense, a diversification in parameters can lead to multiple growth paths (Chamley, 1993 and Palivos, 1995). Thus, in a study of cross-country data, Desdoigts (1999) notes that clubs emerge endogenously and naturally as homogenous classes on the basis of their economic structure.

Below, a summary is provided of the empirical approaches adopted in the detection of convergence clubs. These approaches have applied a range of models (both deterministic and stochastic) in an attempt at identifying the factors that account for the behaviour of heterogeneous groups. In this sense, Durlauf and Johnson (1995) noted that similar initial conditions tend to cause economies to converge towards a common steady state. To date, convergence has been seen to operate at both a global and local level. Baumol (1986) first introduced this term within a country-analysis and subsequent findings show that countries can be divided into a number of different groups. Chatterji (1992) demonstrated that results pointing to the presence of β-convergence (Barro and Sala-i-Martín, 1995) do not necessarily imply the existence of a catching-up process between economies. For this reason, dynamic forces are required that lead economies to a steady state where output levels are equalised. For Chatterji, a negative correlation between growth and initial conditions means a weak convergence process, but nothing more. Strong convergence supposes that $-2<\beta<0$ (being weak when $\beta<0$). Empirically, Chatterji (1992) detected two convergence clubs in a sample of 109 countries, the US being the leader. At the same time, Ben-David (1998) proposes local convergence, dividing world economies into three groups, of which the poorest is also the largest.

But, Durlauf and Johnson (1995) assume that the use of control variables in estimating β-convergence generates a possible multiple equilibrium. In this sense, Durlauf and Johnson follow Azariadis and Drazen (1990) in supporting the presence of non-convexity in the production function for certain ranks. Human capital and initial per capita levels of product are the threshold variables, whereas the methodology combines the sample splitting technique and regression tree analysis. The results from a world-wide analysis highlight the existence of significant differences between groups, this despite the fact that Hansen (2000) has demonstrated that an error exists in the selection of the threshold value. Thus, evidence has been provided both of heterogeneity in production technologies and of local convergence. Canova (2004) takes the analysis further by using threshold estimation for a panel data approach. This makes it possible to consider heterogeneity within estimated groups, whereas Durlauf and Johnson assert that such differences disappear once a group has been formed. Canova's (2004) findings point to the existence of four groups at the European level of regional analysis. Starting from sectorial specialisation, Gianetti (2002) and Mora, Vayá and Suriñach (2005) also identify the existence of European convergence clubs.

Quah (1999), on the other hand, proposes two approaches to explain the existence of convergence clubs: an endogenous formation of coalitions and the generation of various dynamics of convergence that depend on the initial characteristics of the distribution. Among these potential dynamics, he identifies polarisation and stratification processes. Therefore, richer regions tend to converge towards a middle-rich position, while their poorer counterparts tend to move towards a middle-poor position. Thus, the distribution presents bimodality - what Quah (1997) defines as ‘twin peaks’. In this way, convergence can be maintained within clusters but not between clusters. Two opposite forces lead to the consolidation of concentrations around each mode. Finally, joint distribution becomes fragmented, increasing future inequalities. The number of coalitions or clubs (multimodality) and their respective composition depend on the initial distribution. Empirically, Quah (1996) detected bimodality for world economies, though not for European regions. Paap and van Dijk (1998), in conducting a country-level analysis, suggest that divergence can be detected in the levels and persistency of growth rates.

The purpose of this paper is to determine the factors that might account for the distribution of European regional GDP per capita (GDPpc). While a number of studies have examined growth regressions, little research has focused on the effects on the entire distribution. At the same time, it should be borne in mind that while cross-section regressions are useful for comparing average patterns, they are less so in examining entire distributions. Further, the present study seeks to add to the existing literature on the specific role played by convergence clubs in order that we might determine the variables that condition the overall distribution of European regional income or that of a specific club of European regions. By adopting a multivariate approach we should be able to determine the extent to which these factors interact. Initially, we examine results for both EU12 and EU15, but our subsequent results concerning conditioning are used in analysing EU15 distribution. Once the factors have been detected, we proceed to a computation of the effects of changes in probabilities for specific clubs.

This present section has been concerned with providing a discussion of theoretical aspects and examining earlier empirical findings regarding convergence clubs. The rest of the paper is organized as follows. Section two discusses the technique that can be usefully employed in undertaking a conditioning approach to GDPpc distribution. The third section presents our empirical evidence concerning the factors that underpin the formation of European regional clubs. The final section concludes and offers some suggestions as to how regions might escape from a backward club.

2. AN OPTIMUM APPROACH TO THE DETECTION OF THE FACTORS CONDITIONING GDPPC DISTRIBUTION

Thus, our aim was to identify the factors that condition the distribution of European regional GDPpc. The annual data were taken from the EUROSTAT REGIO database GDPpc considered in PPA (1986-2001). Initially, we examined two samples. The first comprised 108 regions in the first 12 EU member states. Here, we combined the NUTS 1 and 2 classifications, which allowed us to achieve a more homogeneous database. NUTS-2 regions were used for Spain, Greece, France, Italy, Portugal, and NUTS-1 regions for the United Kingdom, Holland, Belgium, and Germany. We considered Ireland, Denmark and Luxembourg as single regions (NUTS-0). The second sample comprised 15 member states (1995-2001). Here, in addition, we considered the NUTS II regional classification for Sweden (8) and Finland (5) and NUTS I for Austria (3).

The theoretical debate points to several factors that might account for the distribution. Yet, we wished to determine whether all the factors account for the whole distribution of the activity. However, we would only obtain an explanation of the average pattern by conducting a regression analysis (traditionally detected by applying β-convergence estimations). Thus, while the representative behaviour is described, we learn little about the entire cross-section distribution. Maasoumi, Racine and Stengos (2005) have described the specific effects of the main conditioning variables on the growth rates of different groups of countries. They claim that there can be little doubt, therefore, that separate models are required to examine such groups. Thus, here we decided to adopt a non-parametric approach which would allow us to detect similar distribution patterns within different groups. See Durlauf and Quah (1999) for a formal definition and a description of some of the properties of stochastic kernels in the study of distribution dynamics. Since Quah (1999) first proposed the use of kernels, this technique has been applied by Jones (1997), López-Bazo et al. (1999) and Johnson (2000), among others. But, the study of the shape and mobility dynamics of cross-section distributions seems to be merely informative. A conditioning scheme must be undertaken in order to provide an explanation of the shape and mobility detected. Just such a scheme was proposed by Quah (1996), that is, the way in which the set of theoretical factors presented here in the introduction manifest their conditioning role.

By adopting this technique, estimating conditioned stochastic kernels, we should be able to address the issue as to which factors give rise to the formation of convergence clubs. Thus, in order to understand whether a hypothesised set of factors explains a given distribution we can simply ask if the stochastic kernel transforming the unconditional distribution to a conditional one removes these same features. However, the estimation of density functions only informs us about the overall relevance of conditioning, but here we need also to examine the distribution in part. Thus, stochastic conditioned kernels allow us to examine the role of the conditioning factors for each convergence club. This conditioning approach has been used elsewhere to analyse European unemployment rates (Overman and Puga, 2002), Indian GDPpc distribution (Bandyopadhyay, 2003) and world distribution of output-per-worker (Beaudry, Collard and Green, 2002).

We conditioned the distributions for each period by considering the GDPpc value expressed in terms of its average level in relation to the value of the variable or factor that it conditions, also expressed in terms of its average level.

(1) $$f\,(GDPpc\,/\,X_i) = \frac{\mathrm{GDPpc_i}}{\overline{\mathrm{GDPpc_i}}} \,/\, \frac{\mathrm{X_i}}{\overline{\mathrm{X_i}}}$$

Stochastic kernels are presented by means of three dimensional diagrams. Our figures include axes defined as the income distribution variable for non-conditioned distribution and the income distribution conditioned by $\mathbf{X_i}$ as the conditioned distribution. Conditioned kernels are interpreted as follows. If we detect probability masses running along the diagonal we conclude that the variable used does not contribute to explain the overall GDPpc distribution. The conditioning approach involves a comparison of equation (2), whereas regression models only compare the expected distribution values: E [GDPpc] = E [GDPpc/X_i].

(2) $$f\,(GDPpc) = f\,(\frac{GDPpc}{X_i})$$

By contrast, a relevant conditioned distribution will be detected when mapping from the unconditional to the conditional distribution we find the probability mass running parallel to the income distribution axis. This, of course, is the desired outcome in order to identify $\mathbf{X_i}$ as a conditioning factor. This renders the conditioning factor as one which explains the observed polarisation when the clubs have been detected. This does not rule out the possibility that conditioning relevance might be identified by just a few percentile's distribution. See Overman and Puga (2002) for a visual interpretation.

Our aim, then, is to compare the conditioned and non-conditioned distributions. If they are similar, the whole income per capita distribution will be explained specifically by means of the conditioning factor. At this point, two possibilities are open to us: a comparison of the conditioned distribution of income at several discrete points in time or an examination of the effects of shifts in distribution with changes in conditioning factor. However, this second option would not allow us to detect shape movements in terms of regional ranking. In any case, when both distributions are the same, again, it would not be optimum to validate the coefficient regressions from the β-convergence analysis. Therefore, the mean values will only be representative when we find a single peaked distribution and a high concentration of values around the mean. In this sense, results elsewhere have identified the presence of polarization in the case of the European regions (Esteban and Duro, 1998 and López-Bazo et al., 1999; Boldrin and Canova, 2001). Furthermore, distributions could be analogous just at just one cue. In this sense, Beaudry, Collard and Green (2002) consider changes in the percentile distribution. Three questions are raised from a consideration of all these factors.

The first question concerns the presence or otherwise of a stratification process among European regional clubs. Two reasons need to be examined in order to ensure that there is no mobility within the income distribution. First, findings in the literature demonstrate that persistence is the common trait. Markov chain approaches reveal a second eigenvalue near to one in European regional transitions (López-Bazo et al., 1999 and Magrini, 1999). Second, Mora (2004) showed that although studies about intradistributional mobility are important, it is not the most relevant factor in the evolution of European regional inequality. Similarly, Mora (2005a) illustrates that higher persistence rates in lower income states do not bring about significant changes in ergodic probabilities. Thus, long-run ergodic solutions seem to be highly informative.

The second question to be raised concerns the number of clubs that need to be taken into consideration. On this matter, the literature examines various possibilities. Markov chains are usually applied in considering five states. Early convergence club studies considered three clubs for both world and European regions (Chatterji, 1992; Ben-David, 1994). More recently, Canova, (2004) adopting a predictive density approach, has considered four groups. A stochastic kernel approach allows distributions to be analysed as a means of detecting bimodality (twin-peaked distributions), though bimodality usually generates a medium-stage level that is omitted. However, the convergence literature has typically estimated density functions without taking into consideration confidence intervals. Take for example the distributions of EU12 regional GDPpc in 1986 and in 2001 compared to the overall European average (see Figures 1a and 1b). The confidence intervals for our estimations allow us to detect a greater number of possible clubs than we would without this instrument. So, estimating density functions is not an absolute measure in determining the number of clubs without first considering the confidence intervals for the estimations. Following our previous comments on GDPpc distribution, we estimated density functions for EU15 regions for the years 1995 and 2001. These results are shown in Figures 2a and 2b. A comparison of the EU15 figures with those of EU12 confirm our reasoning about not considering confidence intervals that might detect a higher number of regional clubs.

INSERT FIGURES 1-2 AROUND HERE

So, it appears that we need to split the distribution into groups and determine whether these clubs are stratified over time, though it is not immediately clear how to go about doing this. We believe that the best criterion is a consideration of the inequality of distribution and then to split this optimally. To this end, we define the optimum criteria using an inequality measure. This is an important factor as the groups are built on the basis of differences (inequality): Our main objective being to minimise intra-group differences and to maximise inter-group differences. In addition, we seek a low number of groups so as to limit the loss of data describing the distribution. We chose to use the decomposition of the Gini index proposed by Yitzaki and Lerman (1991) as our inequality criteria. This decomposition presents two advantages: it captures more information as to the evolution of the index and, in addition, it can be broken down. Indeed the breakdown includes three factors that alter the evolution of inequality: changes in the income shares of each of the groups, the differences between the groups, and a stratification index. The stratification index computed is a coefficient that measures the isolation level of each group and can be considered as a homogeneity measure. The analysis of its evolution reveals the group's stability. Davies and Shorrocks (1989) show an optimum partition for the Gini index that is applied in Mora (2005b) for the EU12 regions. The author detected that a two group categorization forces too many disparate regions into a single group and, therefore, the cross-group variation tends to be minimal, i.e. the Gini index is lower than predicted, 13.51% of the global Gini. This share is 99.7% when three groups are selected. So, the optimum solution would be to divide the sample into low, middle and upper levels of European regional development. Our proposal is to use the conditioned stochastic kernels proposal in order to defend the composition of the clubs constructed in Mora (2005b). Thus, the income values are related to those of the average group. Once three groups have been defined, we can then estimate conditioned stochastic kernels as discussed above.

Then, conditioned stochastic kernels related to the grouping criteria are applied in order to detect the suitability of conditioning the stochastic kernel by means of defined groups. The results show that we detect groups of regions concentrated around the group average. But, here the third question is raised: Are these clubs persistent in time? If we compare the conditioned and non-conditioned distributions for the year 2001, the groups can be maintained, although richer regions show higher instability in their probability mass. In addition, the computation of the stratification index derived from the decomposition of the Gini index allows us to affirm that clubs are fairly homogeneous. Thus, the presence of convergence clubs can be defended in the case of the European regions and, moreover, we have seen that these clubs are persistent in time. Next, we need to consider how we might go about explaining a group's conditioning performance. One way would be to analyse the factors that partially or totally condition European regional GDPpc distribution. Our belief is that we should study the entire distribution since in this way we can explain the conditioning factors that allow overlap between the convergence clubs.

3. CONDITIONAL APPROACH TO EUROPEAN REGIONAL GDPPC DISTRIBUTION

We included those factors presented in the theoretical arguments discussed in the introduction to this paper and both neoclassical and endogenous approaches were considered. Thus, the variables to be taken into consideration were: regional saving rates (neoclassical approach), population growth (fertility plus migration), human capital endowment (augmented Solow model, endogenous models and coalitions illustrated by Quah, 1999), R&D (monopolies in technology), sectorial specialisation indexes (output production function differences), financing conditions (capability to enhance other factors), distance to the European core (peripheral location), belonging to a member state (differences in policy making decisions), spatial contiguity (similar distances to the core), infrastructure endowment (physical structural conditions), differences in wages and foreign direct investment (regional attractiveness).

The lack of data for certain variables in certain periods means that it is impossible to carry out a dynamic study. Our final sample covers the EU15 regions; our data enable us to obtain a picture of the factors conditioning GDPpc distribution in 1999. Given the underlying purpose to this study, we conditioned GDPpc in 1999 by considering the following variables: population growth (1996-99) drawn from the REGIO-Database, ageing proportions divided according to the youth, middle-aged and elderly sectors of the population (EUROSTAT) in which we constructed the ratio between the elderly/youth sectors; population density in 1999; human capital endowment proxied by means of shares for low, medium and high levels (EUROSTAT) where we constructed the ratio between high/low levels; European patent applications per million inhabitants (an average for the period 1998-2000, EUROSTAT); sectorial specialisation indexes (see above), distance to the European core; dummies assigned to condition of belonging to a member state condition belonging, compensation per employee (Cambridge Econometrics Database) and a time cost connectivity to whole infrastructures from each node (ICON index - Connectivity to transport terminals by car (minutes) weighted by surface of all NUTS). All variables were related to their average value as we did for the GDPpc level. Conducting this study at the regional level does not allow us to consider any further variables.

So, in order to characterise the regions in each club, we computed sectorial specialisation indexes. The regional-sectorial concentration coefficient is L_{ij}. From this index, it is possible to know if one sector j is more highly concentrated in region i in comparison with the overall EU value (L_{ij}>1) or, on the contrary, if a small proportion of the Gross Value Added (GVA) of j is located in this region, L_{ij}<1, compared to the EU average. Thus, specialisation patterns are compared to an average value for the EU. The regional-sectorial concentration coefficient is defined as follows where x_{ij} is the GVA in region i in sector j; $x_{i\cdot}$ ($x_{\cdot j}$) the total GVA in region i (sector j); x is the total GVA.

$$(3) \qquad L_{ij} = \frac{x_{ij} / x_i}{x_j / x} \qquad i = 1,\ldots,N;\ j = 1,\ldots,R$$

These results should allow us to determine whether there is a relationship between regional wealth measured in terms of GDPpc for each of the groups and each sectorial specialisation. The classification sector considered is NACE-CLIO RR17 and the data are drawn from the Cambridge Econometrics Database. All specialisation indexes were also related to their average value. In order to reduce the number of variables belonging to specialisation indexes we computed various average indexes. Thus, the low-tech industrial sector included: Food, beverages and tobacco, Textiles and clothing and Transport equipment; while specialisation in high-tech services was computed by including Transport and Communications and Financial services.

A particular criticism made against the use of stochastic kernels is the bivariate conditioning that it involves. The use of the bivariate approach impedes the interaction of some of the conditioning factors in the explanation of the whole cross-section distribution. This factor is well captured by means of a regression approach, though once again for an average representative region. Thus, if we condition by means of the bivariate approach, it is likely that we will find no relationship when the regression coefficients are still significant. As discussed earlier, Maasoumi, Racine and Stengos (2005) have suggested that the regression approach be avoided so as to describe different convergence clubs. Therefore, here we propose a multivariate approach so that the relevant results are analysed by means of factor analysis. In this way, we are able to see the conditioning factors that actually correlated with each other. However, the Kaiser-Meyer-Olkin measure of sampling adequacy provides a middling value. Likewise, the multivariate approach is avoided here because of the degree of uniqueness of most of the conditioning variables considered. Thus, we only study the variables that condition distribution in a univariate manner. Figure 3 shows the results of the conditioned kernels for the entire distribution. As mentioned above, conditioning three detected clubs is not a good option because overlapping is not permitted.

INSERT FIGURE 3 AROUND HERE

Our results show that the variables differ on several matters. There appear to be differences in the number of clubs (peaks), some of which do not condition, while others have a partial effect on the distribution. Based on our conditioned bivariate kernels we need to consider the number of peaks and determine whether the conditioning is actually working. Two clubs are obtained for female unemployment and the agriculture specialisation index, whereas more than two clubs seem to be detected for average number of patents, education polarization (strongly peaked), high-tech services specialisation index, compensation per employee (a club with high values – lowest levels of salaries with lower development level) and infrastructure cost index (showing agglomerated economies). Grouping into five clubs (Davis and Shorrocks, 1989 criteria is applied) splits the distribution into two-three groups. Thus, the splitting criteria used results in the identification of three final clubs thanks to the inequality decomposition proposed. The factor of belonging to a member state had hardly any conditioning effect on the distribution but it presented a marked peak (about two-three clubs). We should stress that a few of these variables with peak distributions proved not to be significant in our regression results. Recall that regression still provides evidence solely of average behaviour. Thus, in conditioning the variables should be understood as complementary factors (remember that factor analysis did not identify any interactions).

However, one peak was obtained for the following conditioning variables: Fuel and chemical specialisation index, low-tech manufacturing index, electricity specialisation index, construction specialisation index, growth in population and distances to core. By contrast, the variables which did not condition were: the ratio of elderly population to the number of young members and the low-tech services specialisation index.

Next, adopting a conditional Markov chain approach, we find that the best conditioning variables present the lowest eigenvalues (persistence index). Our approach considered five states assuming an equal number of regions within each state. A lower eigenvalue denotes minor coincidences between the conditioned and non-conditioned distributions, which causes the distribution to become polarized into clubs. Ergodic distributions reveal a polarized picture coinciding with the results from our conditioned kernel approach (see Figure 4). However, the ergodic probabilities are more informative. We can specify better the number of clubs detected for each of the conditioning factors. Absorbing states are found for the agricultural specialisation index and the infrastructure cost index, which impedes any further comments on these variables. However, in the case of those factors plotted in Figure 4 we can see that bipolarization exists for conditioning based on education polarization, female unemployment and the average number of patents. Likewise, our grouping criteria that split into five clubs polarize the distribution into two final groups with an additional lower club, albeit with a small probability. By contrast, belonging to a member state, compensation per employees and high-tech services specialisation splits the distribution into more than two clubs.

INSERT FIGURE 4 AROUND HERE

However, we should question whether these clubs are persistent, albeit that economic policies do affect ergodic distributions. Thus, a sensitivity measure for Markov chains was computed in order to observe changes in the ergodic distributions when small changes occurred in each state (we assume increases of over 0.1 for each state and decreases of a half for contiguous states). We follow the proposal in Mora (2005a). Only those states at both cues show the higher changes in ergodic probabilities (with the exception of the aforementioned grouping criteria case). Figures 5a and 5b illustrate the changes in ergodic distribution for extreme increases in state probability. Thus, changes in the first state cause the situation of the regions to worsen, while the changes in the fifth state are indicative of improved conditions. Our calculations show that the state of an economy worsens, if increases are recorded in female unemployment rates, in the number of patents and improves for the high-tech services specialisation index. Thus, the factors that could trap a region most are: the non-integration of women within the labour force and an increasing number of patents or the specialisation of financial services without these factors being accompanied by any increase in GDPpc. Nevertheless, our main concern is detecting the factors that improve regional income at the upper development stages. Our results show that reducing female unemployment, decreasing educational polarization and, in particular, improving the region inside its country are the main factors. Thus, the implementation of member state policies remains the key factor to ensure a region escapes from low levels of development.

INSERT FIGURE 5 AROUND HERE

Finally, Figure 6 depicts the changes that would occur if we were to alter the composition of the three clubs detected by means of our grouping criteria. Meanwhile, the second and third clubs tend to incorporate changes by taking half from contiguous clubs, while the first club does not tend to collect probabilities from its neighbouring clubs. This finding confirms that backward regions face major obstacles in achieving higher rates of development. The positions of the European regional clubs persist. Thus, convergence regressions would only reflect convergence inside clubs.

4. CONCLUSIONS

Here, the European regional distribution of GDPpc has been conditioned and evidence has been provided for the existence of convergence clubs among these regions. Income distribution differences would seem to be due to a range of complementary factors. Moreover, they point to a process of bipolarization from conditioning based on educational polarization, female unemployment and the average number of patents. Finally, our grouping criteria of splitting into five clubs polarize the distribution into three final groups with one trapped at a lower rate of development. Overall regression results detect this convergence between regions, but do not show that this convergence actually takes place inside clubs but not between clubs. After computing changes in ergodic probabilities using a conditioned Markov chain approach, the factors of belonging to a member state and policies regarding female unemployment and the reduction in the polarization experienced in the education system have been detected as the only means for modifying a polarized regional structure. However, our main concern is that simply modifying the ergodic probabilities of backward club does not necessarily allow a region to escape from it.

What policy actions could be implemented, therefore, in order that Europe’s poorer regions might avoid isolation? The first option involves government action that capitalises on knowledge spillovers and externalities. This solution is closely related to the significance in conditioning of the belonging to a member state factor. Jalan and Ravallion (1997) point out that the growth perspectives of poorer zones depend on the government’s capability to invert the tendency to under-invest. Baland and Francois (1996) recognise that public intervention has two conflicting effects: the first is a crowding out effect for private investment that is a negative incentive effect. However, Klundert and Smulders (1996) question temporary public intervention because the need is for the long-term effects of these policies. An alternative for public policy is to increase public investment. In addition, externalities are usually local. For this reason, intervention should be selective and aimed at specific industrial sectors. Baland and Francois (1996) consider that improvements could lead an economy to higher levels of physical capital that exceed the threshold. The second option is to promote foreign direct investment (physical capital, education or the training of technicians). Finally, a third possibility is to promote an optimum size and structure for the finance market by incorporating the “big push” idea (Murphy, Shleifer and Vishny, 1989). Nevertheless, simultaneous processes in neighbouring regions should accompany individual regional efforts. Durlauf (1991) affirms that complementarities between activities and companies are necessary in incomplete markets. The basic idea is that a simultaneous and sufficient investment flow addressed to diversified industrial sectors would allow access to externalities (enhancing the size of the domestic market and promoting infrastructure). Therefore, the global higher effect succeeds.

However, doubts have been expressed about the effectiveness of economic policies aimed at escaping from low development traps. In this sense, Caplan (2003) devises an economic–political model to explain why the convergence hypothesis fails even though good economic policies seem to be a sufficient condition for strong economic growth. Azariadis (2001) has considered four orthodox policies and their consequences. First, public subsidies oriented at education are effective for medium levels of development, but they are not effective for backward economies. This finding is in line with our results i.e. the polarization in education levels recorded for backward regions. As far as foreign investment is concerned, there has been a production enhancement but this has not been noted for national income or the consumption in less developed economies. Third, the liberalisation of the domestic financing market has led to decreases in the saving rate and in the short-run accumulation of capital.

Finally, Azariadis claims that premature liberalisation increases the probability of falling into a trap because of the presence of lower levels of productivity. Thus, the question needs to be considered as to whether European regional integration has had the effect of consolidating regional incomes without first correcting certain policy measures. Therefore, regions seeking to abandon a growth development trap should bear in mind that such policy measures may be ineffective. Our stratification results are therefore interesting in being able to detect whether economies persist in adverse scenarios of development in spite of significant efforts being made on the policy front.

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Figure 1 Estimated density functions for EU-12 regions GDPpc: 1986-2001

Figure 1a. GDPpc-1986 distribution

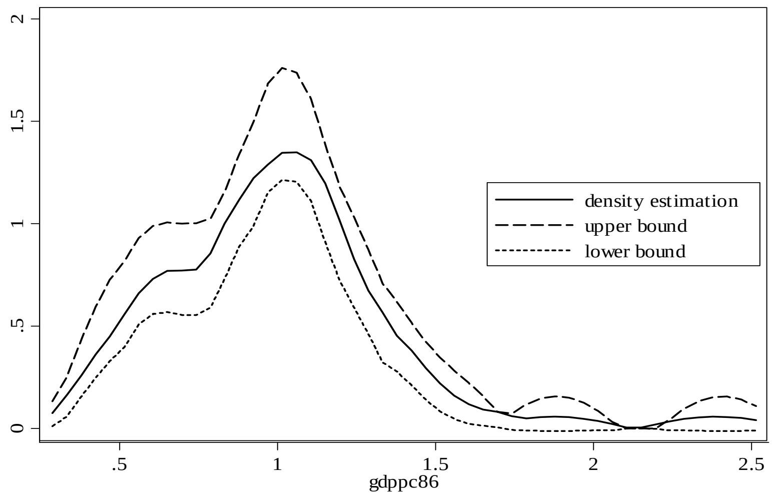


Figure 1b. GDPpc-2001

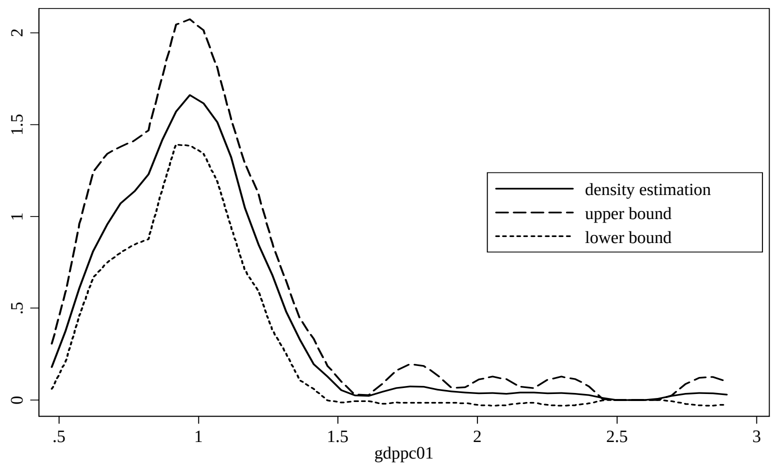


Figure 2 Estimated density functions for EU-15 regions GDPpc: 1995-2001

Figure 2a. GDPpc-1995 distribution

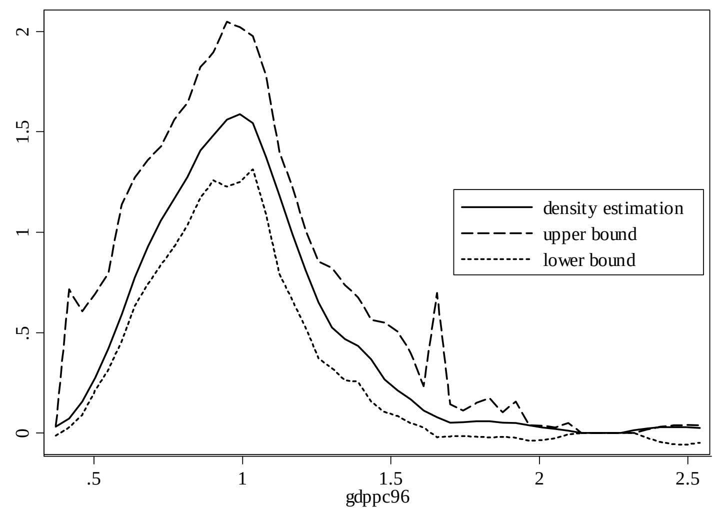


Figure 2b. GDPpc-2001

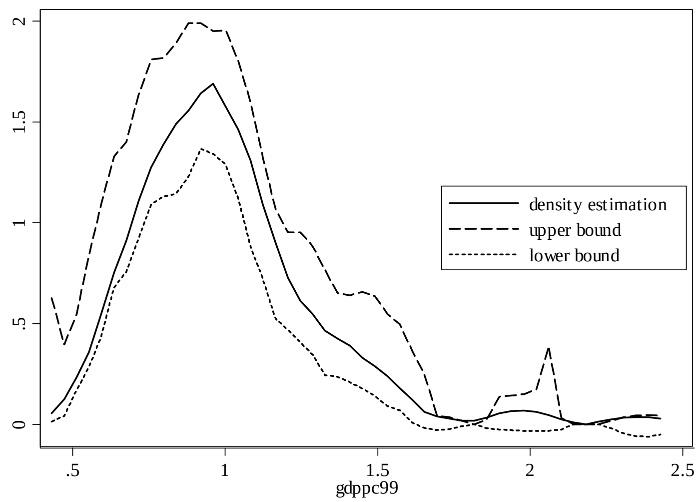
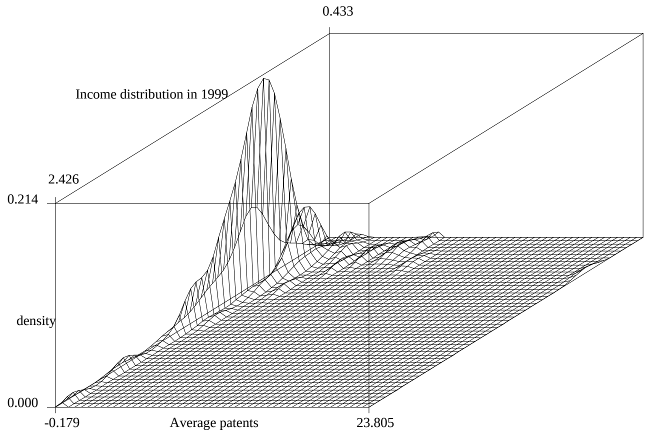
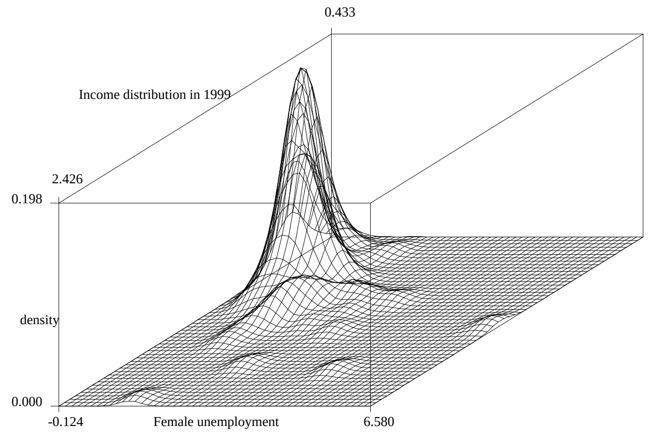


Figure 3 Conditioned GDPpc distribution (1999): Cd (significance in regression results) and Cn (non-significant)

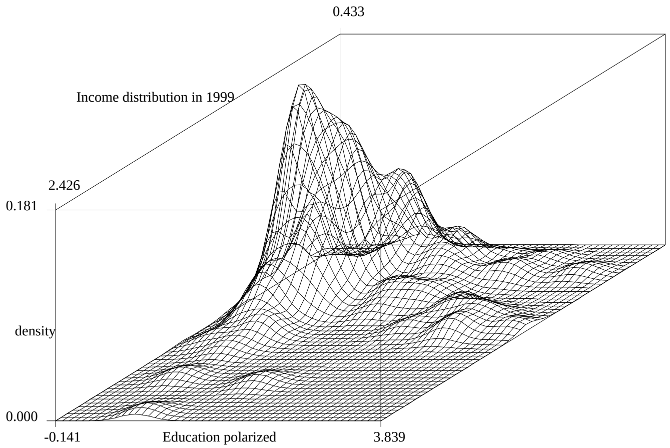
Average patents (cd1)



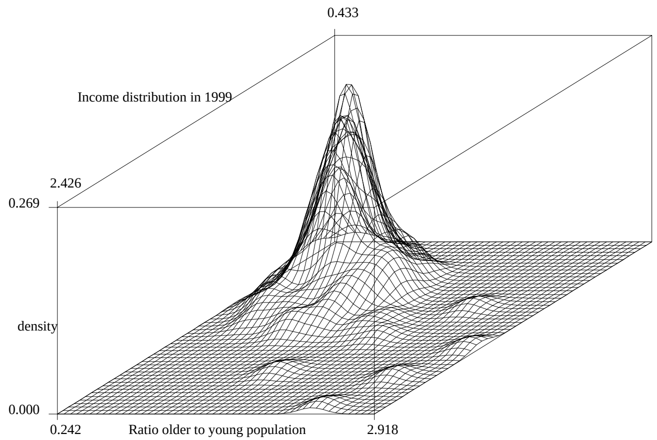
Female unemployment (cd2)



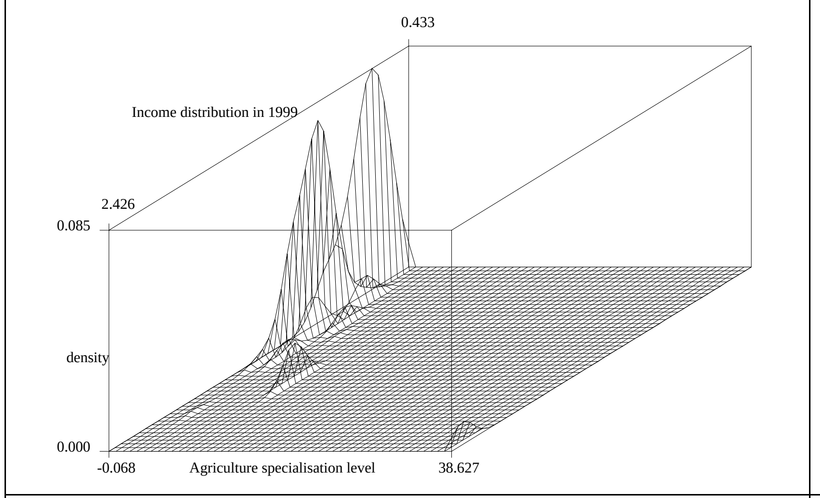
Polarization in education (cd3)



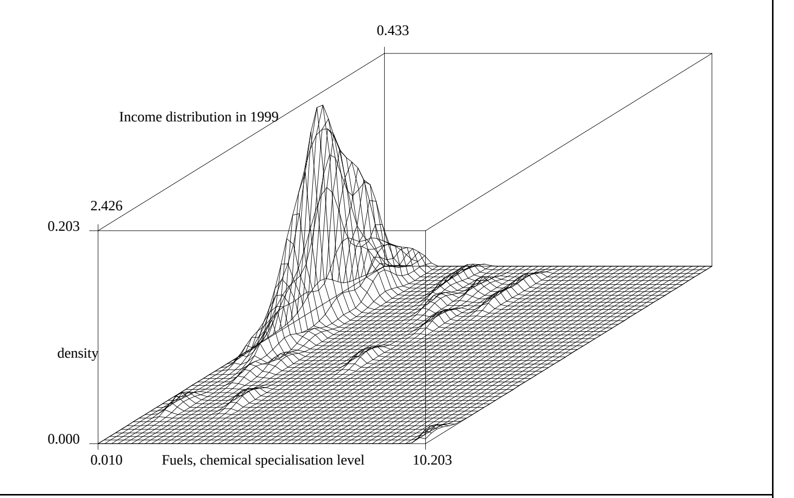
Demographic ratio (cd4)



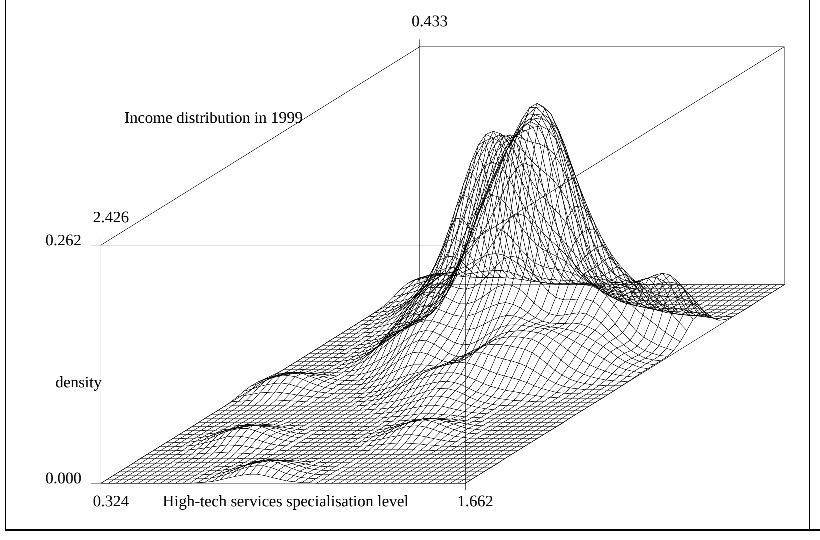
Agriculture specialisation indexes (cd5)



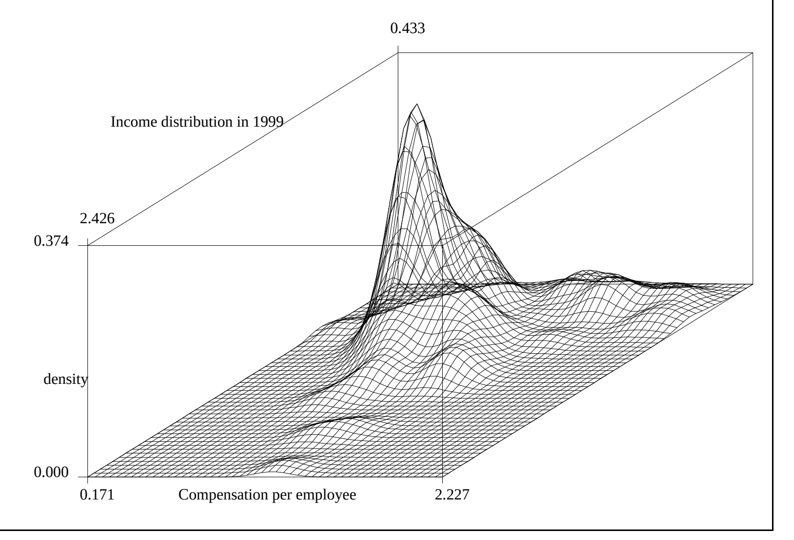
Fuel and chemical specialisation (cd6)



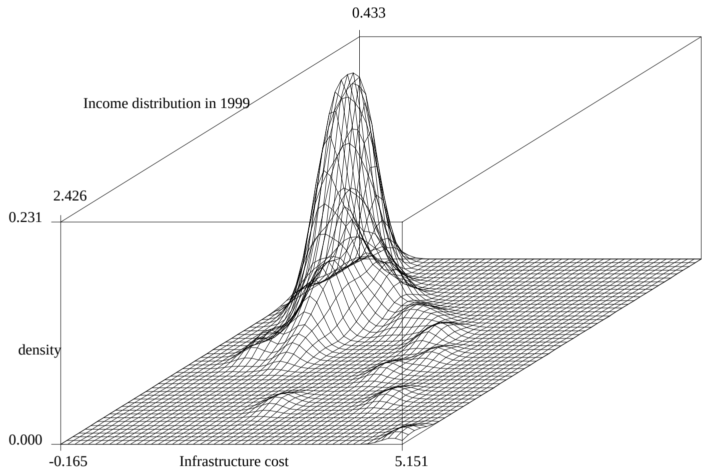
High-tech services specialisation (cd7)



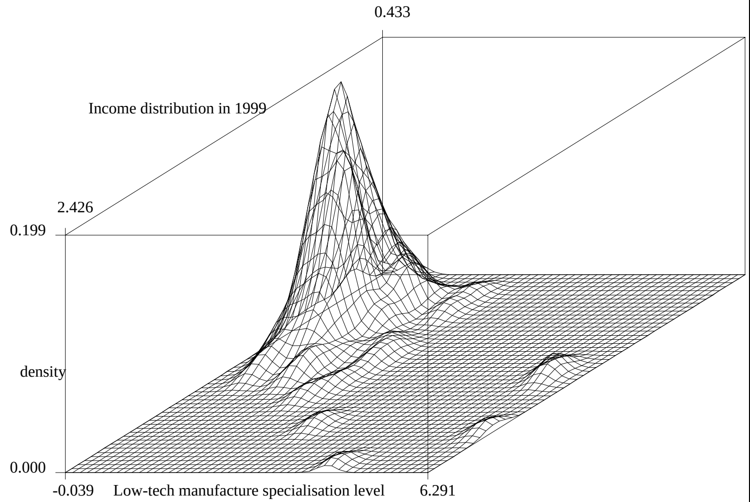
Compensation per employee (cd8)



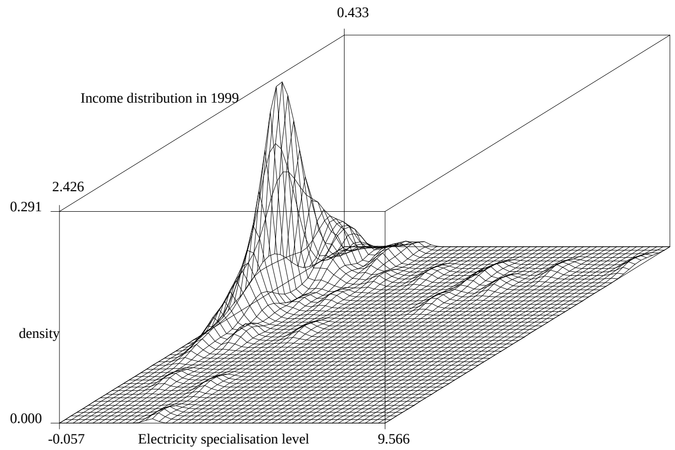
Infrastructures cost index (cd9)



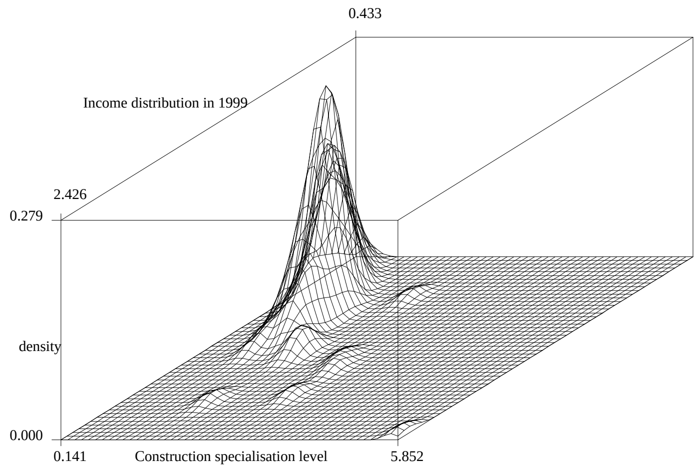
Low-tech manufacturing index (cn1)



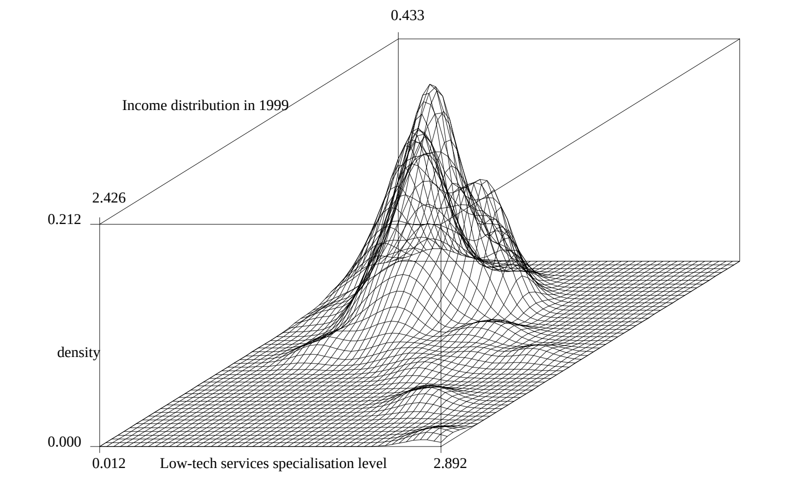
Electricity specialisation (cn2)



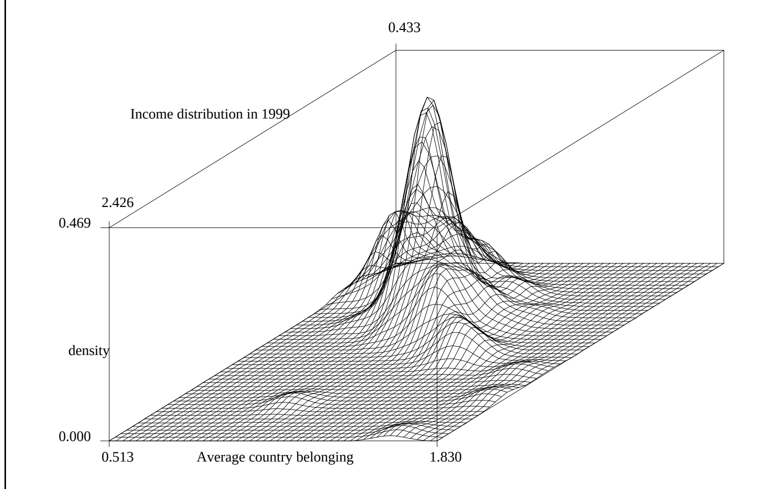
Construction specialisation (cn3)



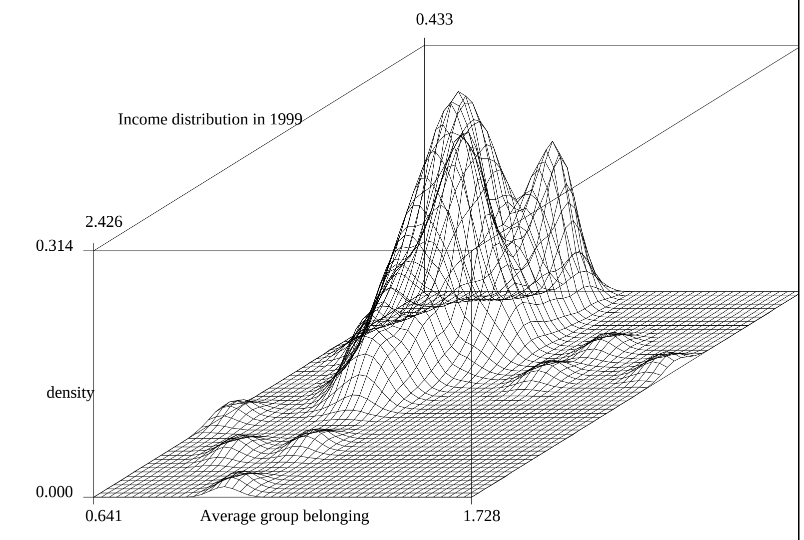
Low-tech services specialisation (cn4)



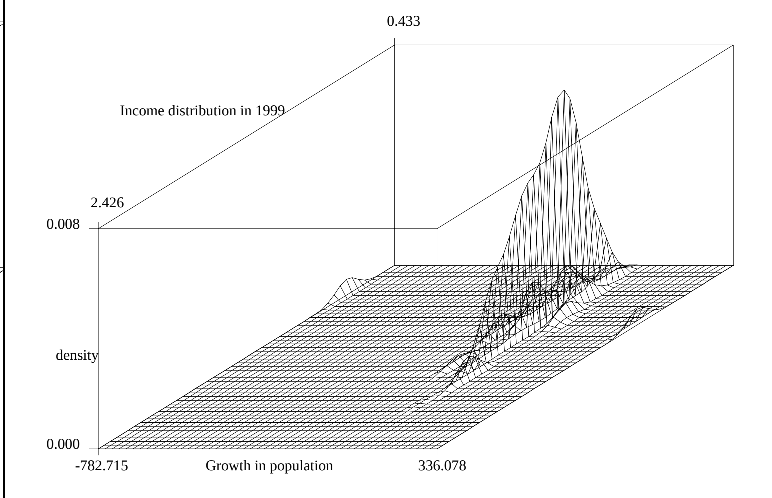
Belonging to a country



Group belonging (5 groups)



Growth in population



Distances to core	
	

Figure 4 Ergodic distributions (5 states)

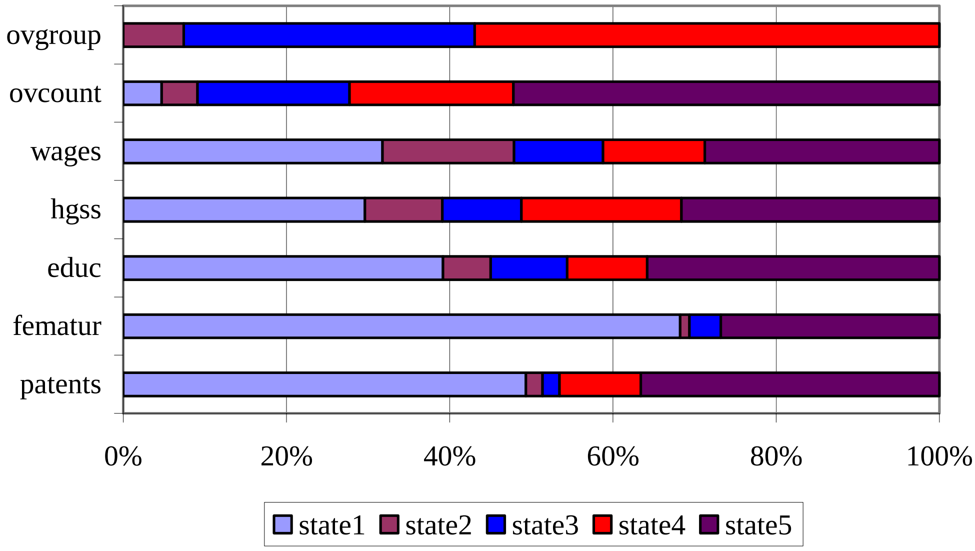


Figure 5 Changes in ergodic distributions: Δp_{ij}=0.1 for polarized states
Figure 5a Changes in first state

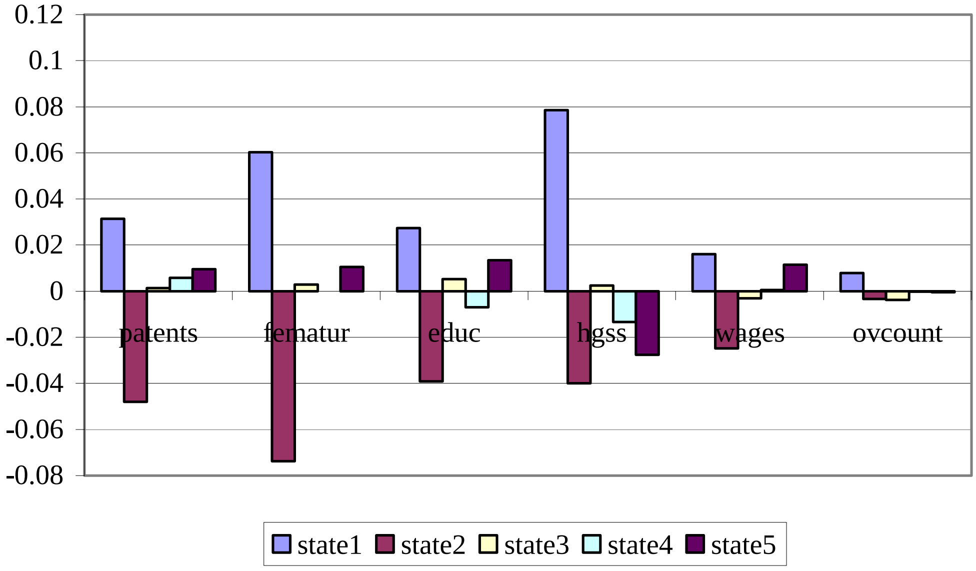


Figure 5b Changes in fifth state

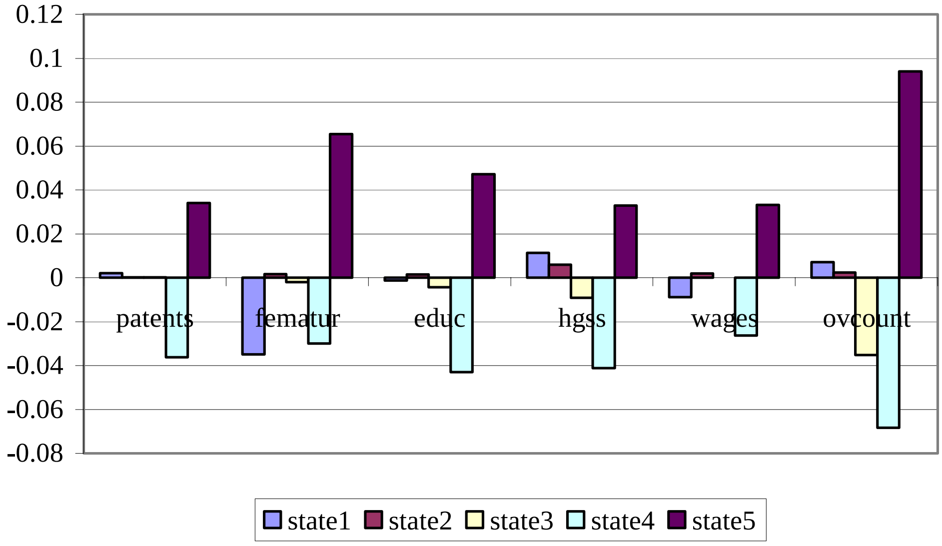


Figure 6 Changes in ergodic distributions for clubs by grouping criteria